Small Business Innovation Research/Small Business Tech Transfer

Development of an Elastomeric Force Balance, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

One focus of NASA aerodynamics research is enabling energy efficient flight through drag reduction technologies. A variety of drag reduction techniques have shown promise and are under investigation, including both active flow control and surface microstructure concepts. Experimental verification of the performance of any drag reduction technique, however, can be challenging. Drag forces are generally significantly smaller than lift and side forces. Furthermore, drag reduction techniques are operating on components of the model, and therefore, a model mounted drag balance is required to evaluate the performance of the drag reduction technology. Further complicating the measurement is the fact that active flow control requires that high pressure air or electrical power be passed through the model mounted balance without impacting the measurement. Over the past 10 years, ISSI has developed an optical sensor for measurements of skin friction known as Surface Stress Sensitive Film (S3F). S3F has demonstrate good sensitivity to skin friction while maintaining very high common mode rejection between the pressure and skin friction forces. ISSI has recently designed and built a prototype drag balance based on this sensor. The balance design is structurally similar to a traditional balance, employing four pillars S3F as the active elements. Rather than monitoring strain in the pillars, as is done with a traditional balance, the vertical and horizontal deformation of the pillars is monitored and these displacements are converted to forces and moments. Preliminary results on the prototype balance indicate that forces smaller than a mili-Newton may be resolved, and there is no measureable coupling between the drag force and the normal or side forces. Development of a force balance technology that can be integrated into a model and measure small changes in drag would be of significant value for the development of energy efficient flight.

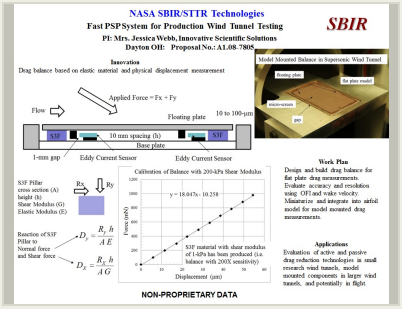

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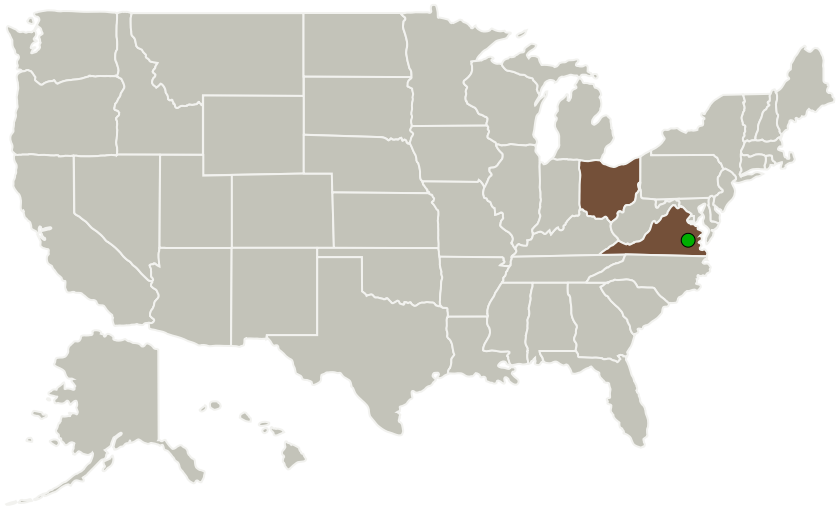
Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

Development of an Elastomeric Force Balance, Phase I

Completed Technology Project (2016 - 2016)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Innovative Scientific Solutions, Inc.	Lead Organization	Industry	Dayton, Ohio
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139770)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Innovative Scientific Solutions, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

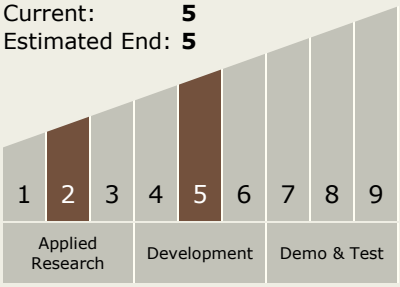
Carlos Torrez

Principal Investigator:

Jessica Webb

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



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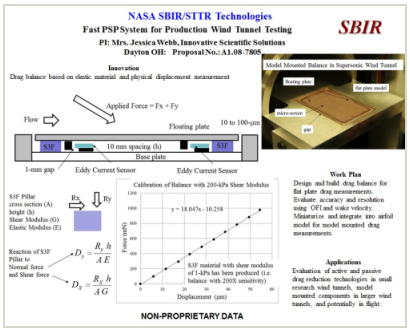
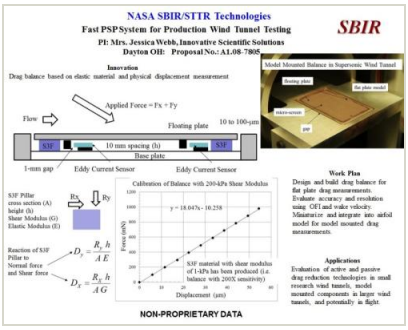
Images



Briefing Chart Image
Development of an Elastomeric Force Balance, Phase I
(https://techport.nasa.gov/image/133118)



Final Summary Chart Image
Development of an Elastomeric Force Balance, Phase I Project Image
(https://techport.nasa.gov/image/133978)

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.1 Aerodynamics

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System